SIEMENS

LS4Soft
Configuration and Diagnostics Software
for SIGUARD Laser Scanner LS4-4

User Manual   C E

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1   About the User Manual

This documentation contains all information regarding proper use of the configuration software LS4Soft. It is supplied with every delivered system and is intended for use by the planners, operators and maintenance personnel of systems that are safeguarded by the SIGUARD laser scanner LS4-4. The documentation must be kept so that it is easily accessible at all times.

Safety precautions and warnings are designated by the

symbol ⚠.

Please verify that the LS4-4 laser scanner is installed and mounted so as to be ready for operation as specified by the Technical Description No. 3RG7838-4BE. Siemens AG is not liable for damage resulting from improper use of its equipment. Familiarity with these two manuals constitutes part of the knowledge required for proper use.

The LS4Soft software was designed exclusively for the LS4 scanner series. The user manual was written with reference to the SIGUARD laser scanner LS4-4 with a detection zone range of 4 meters. For this reason, both designations (LS4-4 and LS4) are used in the text and in the illustrations.

Version of the contents: V1.01

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2 First Steps

2.1 Foreword

This manual describes the functional and performance features of the LS4Soft software. LS4Soft is an extremely powerful configuration and diagnostics software program designed for use with the laser scanner SIGUARD laser scanner LS4-4. During development, the highest priorities were placed on reliability and user-friendliness. LS4Soft is not suitable for configuring devices made by other manufacturers.

The organization of this user manual parallels the sequences and hierarchies of the software menu points. The manual provides you with clear information regarding the structures and functions of LS4Soft. Where more complex subjects are concerned, you can refer to the screen shot illustrations, which give you a concrete look at the points under discussion. The software itself offers an additional „help" text for each function button. Simply move the mouse pointer to a function button, and a descriptive pop-up window will appear automatically.

Please keep this description in a safe place and make sure that it is accessible during the entire service life of the software.

2.2 Software Structure

LS4Soft follows a subject-related tree structure:

- The user interface was designed to be Microsoft® compatible as far as possible in order to shorten the learning curve.

- Subject buttons refer to function groups and the detailed functions incorporated in them.

- Function buttons enable desired functions to be performed; many of these buttons offer dialog boxes and drop-down menus to simplify the selection process.

- Standard buttons contain frequently required functions and are not linked to any specific subject.

2.3 Required Components

The following components are required for the initial startup:

- Laser scanner LS4-4, installed as specified in Technical Description No. 3RG7838-4BE

- PC or laptop with color monitor and installed LS4Soft program

- RS 232 interface cable (1:1, without cross-connection) or RS 422 interface cable for the connection to X2 (see Chapter 2.8)

- Control cable (power supply, changeover, restart) for the connection to X1 (see Chapter 2.8)

2.4 System Requirements / Software

Microsoft® Windows 95/98/NT®/2000

2.5 System Requirements / Hardware (PC)

- Intel® processor, Pentium® class or better (or compatible models such as AMD® or Cyrix®)

- At least 16 MB RAM

- 3 1/2'' disk drive

- Hard drive with at least 8 MB of free memory
  You may need more disk storage if detection zone data and/or configuration data are going to be stored.

- Mouse

- Free RS 232 serial interface, or alternatively, RS 422 interface

2.6 System Requirements / Hardware (Cables, Connectors)

- Wire cross-section of cable X1: at least 0.5 mm^2
- Outer diameter of the cable: between 5 mm and 10 mm
- Maximum cable length X1: 50 m
- Maximum cable length X2: 10 m for RS 232
- Maximum cable length X2: 50 m for RS 422
- Use shielded cables
- Use only the LS4-MG connectors and the LS4-MG cover provided with the delivered system.

2.7 System Requirements / Other

- Printer (black-and-white or color)

Please refer to Chapter 4.2 in the Technical Description of the SIGUARD laser scanner LS4-4.

2.8 Interfaces and Pin Assignments for the SIGUARD Laser Scanner LS4-4

Interface No.	Interface Type	Interface Function
X1	SUB-D15	Connections for: • Power supply • Switch and signal cables
X2	SUB-D9	Interface SIGUARD laser scanner LS4-4 - PC • Parameter configuration • Detection zone and warning field definition • Data transfer • Diagnostics

Pin assignments for interface X1
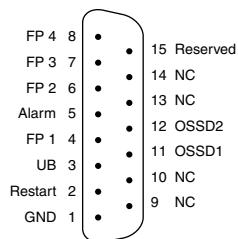
```
FP 4   8  •     •  15  Reserved
FP 3   7  •     •  14  NC
FP 2   6  •     •  13  NC
Alarm  5  •     •  12  OSSD2
FP 1   4  •     •  11  OSSD1
UB     3  •     •  10  NC
Restart 2 •     •  9   NC
GND    1  •
```

Pin assignments for interface X2 used as an RS 232 port

```
       1  •     •  6  RS232 recognition
TxD    2  •     •  7  NC
RxD    3  •     •  8  NC
       4  •     •  9  Reserved
GND/   5  •
shield
```

Pin assignments for interface X2 used as an RS 422 port

```
Tx-    1  •     •  6  RS422 recognition
Tx+    2  •     •  7  NC
Rx+    3  •     •  8  NC
Rx-    4  •     •  9  Reserved
GND/   5  •
shield           Connection of
                 PIN 5 to PIN 6
```
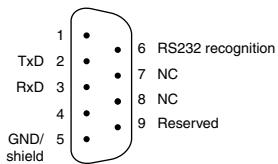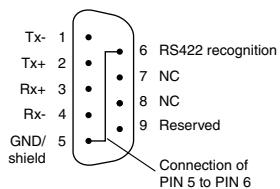
Fig. 1   Interface pin assignments with a view to the
             SIGUARD laser scanner LS4-4

PIN	Signal	Description
1	GND	Ground for the supply voltage
2	Restart	Input, scanner reset, and connecting the RESTART button
3	UB	Supply voltage +24 VDC
4	FP 1	Changeover to field pair 1
5	Alarm	Semiconductor output that switches off when the warning field is violated as well as for warning messages such as „window slightly dirty", error messages such as „window very dirty", and for internal errors (the functions can also be selected in combination).
6	FP 2	Changeover to field pair 2
7	FP 3	Changeover to field pair 3
8	FP 4	Changeover to field pair 4
9	NC	Not connected
10	NC	Not connected
11	OSSD 1	Semiconductor output, switches off when the detection zone is violated, Channel 1
12	OSSD 2	Semiconductor output, switches off when the detection zone is violated, Channel 2
13	NC	Not connected
14	NC	Not connected
15	Re-served	Reserved for testing purposes, no wiring

Pin Assignments for Connector X1

A field pair consists of one detection zone and one warning field.

PIN	Signal	Description
1	NC	Not connected
2	TxD	Data communication, transmit
3	RxD	Data communication, receive
4	NC	Not connected
5	GND / shield	Ground / shield (connect with PE to the electronics cabinet only)
6	RS 232	Not connected
7	NC	Not connected
8	NC	Not connected
9	Reserved	Reserved for testing purposes, no wiring

Pin Assignments for Connector X2 used as an RS 232 Port

PIN	Signal	Description
1	TxD-	RS 232/ RS 422 transmitted data
2	TxD+	
3	RxD+	RRS 232/ RS 422 received data
4	RxD-	
5	GND / shield	Ground / shield (connect with PE to the electronics cabinet only)
6	RS 422	Select RS 422 interface by connecting a bridge to pin 5
7	NC	Not connected
8	NC	Not connected
9	Reserved	Reserved for testing purposes, no wiring

Pin Assignments for Connector X2 used as an RS 422 Port

2.9 Connecting the SIGUARD Laser Scanner LS4-4

To configure the scanner, connect the control cable (X1) to the power supply (safety transformer 24 V, 2.5 A, 1.25 A semi-delay fuse) and the interface cable (X2) to the PC or laptop. Before starting up the system, please verify the connector assignments, the wiring, the supply voltage and the fuse protection. Although the scanner is robustly constructed and equipped with various internal safety mechanisms, it is possible that damage could be caused by faulty wiring.

⚠ For further information, consult the Technical Description of the SIGUARD laser scanner LS4-4 (Chapter 4.2).

PIN	Signal
1	GND
2	Restart
3	UB
4	FP 1
5	Alarm
6	FP 2
7	FP 3
8	FP 4
9	NC
10	NC
11	OSSD 1
12	OSSD 2
13	NC
14	NC
15	Reserved
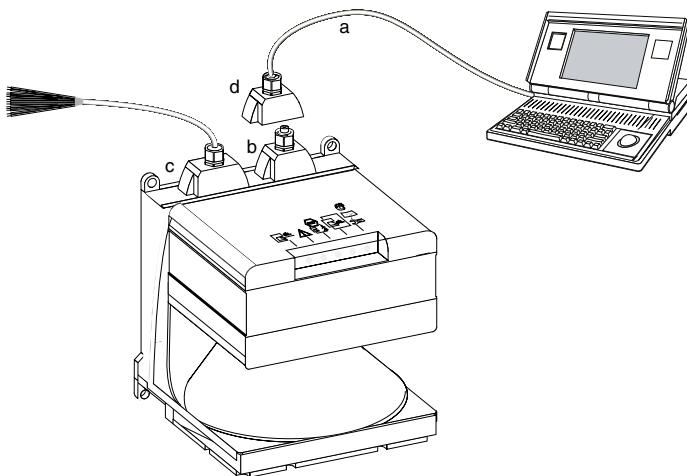
a = Connection for setting parameters only
b = Dummy connector
c = Connector X1 (15-pin, SUB-D)
d = Connector X2 (9-pin, SUB-D)

2.10 Installing the Software

Place diskette #1 into the appropriate disk drive.

Start the installation program Setup.exe. After selecting the desired language (German or English) you will be asked for the installation path. The folder „Siemens AG" is recommended. Confirm the entries. Now you can load the program successively using the diskettes. Once this process is completed, LS4Soft is ready for operation.

To enable the program to be called up faster, use the Microsoft® function „Create shortcut" to add the LS4Soft icon to the desktop.

3 Calling Up LS4Soft and Starting the System

3.1 Establishing Communication from PC to LS4-4

- Start the software by double-clicking either on „LS4_hmi.exe" or on the desktop icon. For a few seconds you will see the software startup page indicating the version number. Then the main menu appears with a dialog box for selecting the authorization level (see Chapter 3.2).

- Apply the supply voltage to the SIGUARD laser scanner LS4-4. The scanner will now automatically attempt to communicate with your PC.

- Once the PC and scanner have been successfully synchronized, the text in the info field changes from „LS4 sync" to „LS4 connect".

- The current configuration of the LS4-4 is transferred to the PC. A progress bar on the screen shows the configuration data being loaded.

- Please replace the standard passwords with individual passwords. A request to this effect will appear on the screen (see Chapter 3.3 and 9.4).

3.2 Startup Page with Verification of Safety-Relevant Parameters

- The LS4 configuration and the status information are now automatically transferred and displayed. Please compare these safety-relevant data with the parameters required for the current application.

- After you close the dialog box, you can begin configuring the scanner.
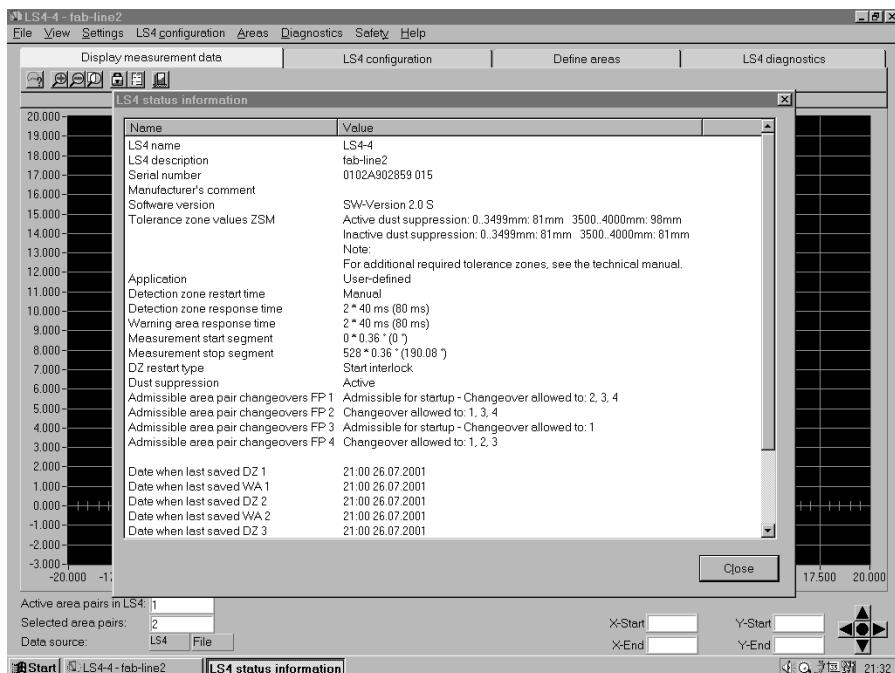
3.3 User Levels

To ensure that the device configuration is performed only by trained and authorized personnel, LS4Soft uses the dialog „Change authorization level" to distinguish among various authorization levels providing access to various ranges of function. The following levels are available:

Level	Info Field	Password	Access to Functions
Operator	(Be)	- - -	General settings, display and evaluation of mea-surement values, transfer-ring configuration data from LS4-4 to PC, no changes to the system configuration
Mainte-nance	(In)	SIGUARD	Device configurations can be loaded from diskette and saved in the LS4-4. It is not possible to make changes to the parameters themselves.
Autho-rized customer	(AK)	LS4SIG	Complete access to all user-related functions and parameters.
Service	(Se)	WINCALIB	Access to the scanner win-dow calibration function for trained personnel
Produc-tion	(Fe)	- - -	Manufacturer-specific access
Develop-ment	(En)	- - -	Manufacturer-specific access

⚠ The factory-preset password for the authorized customer/ safety official (AK) is „LS4SIG". During the initial configuration of the SIGUARD laser scanner LS4-4, the safety official must select and save new passwords for (In) and (AK); the (electronic or hard-copy) carrier of this information must be kept locked up in a secure location. Each password can be entered using either upper-case or lower-case letters; the password acceptance is not case-sensitive. Since the

authorization level „Operator" does not allow any changes to be made to the device configuration, it is not password-protected. After the authorization level has been determined, all inaccessible function buttons are disabled and colored light gray.

In order to access the service (Se) level, you need both the correct password and a security diskette. For further information, see Chapter 9, „Additional Functions on the Main Menu Line".

4   Main Menu

4.1   Menu Structure

The main menu displays the measured contours and detection zones. It also features subject-related menu control and additional information fields. This is a very user-friendly method for changing the operating mode and for accessing many different dialogs and functions without losing track of what is going on. After selecting one of the four subject buttons, you can choose from relevant function buttons offering related selection boxes and drop-down menus. This method for guiding the operator is used throughout the program.

4.2   Main Menu Line

File View Settings LS4 configuration Areas Diagnostics Safety Help
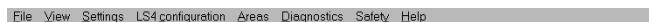
This line contains the complete catalog of available functions.

4.3 Subject Line

| Display measurement data | LS4 configuration | Define areas | LS4 diagnostics |

- „Display the measurement contour" button
  Measurement mode is activated; the current detection
  zone and warning field are shown in red and green,
  respectively. Additional programmed fields can be
  selected individually by means of a dialog (e.g. reference
  display).

- „LS4 configuration" button
  All functions required for configuring the scanner are
  available here.

- „Define detection zones/warning fields" button
  This subject area allows you to create application-specific
  definitions of the four detection zones and the four warn-
  ing fields using either the mouse or numerical input.

- „LS4 system data" button
  This subject area contains data for identifying the device
  and diagnosing errors.

4.4 Standard Buttons in the Function Line

Frequently required functions are available at all times in the
function line below the subject buttons.

- Zooming (enlarge or reduce picture, total view of 80 x
  140 m)

- Change authorization level

- Display PC error list (list of PC-related errors with date
  and time)

- End configuration program

4.5   Information Field Line

You can find information regarding the operating mode and the current authorization level in the information line at the very bottom of the screen as follows (from left to right):

- Current data communication between PC and LS4-4

    - „LS4 sync"   for synchronizing the communication between scanner and PC

    - „LS4 connect   „when the data transfer connection is established

- Operating status of the scanner

    - „LS4 > Measurement operation" shows that the scanner is actively recording measurement data

    - „LS4 > Configuration „shows that configuration data are being transferred with the OSSDs switched off

    - „LS4 > Error"   signals a system error with the OSSDs switched off

- Selected subject button of the user program

    - „Display the measurement contour„

    - „LS4 configuration"

    - „Define detection zones/warning fields"

    - „LS4 system data"

- Field status

    - Detection zone and warning field violated/switched off – indicators SF and WF are red

    - Warning field violated – indicator WF is green

    - Detection zone and warning field clear – no indicator

- Current access level
  Depending on the setting, the following abbreviations are displayed:

  - Be   for operator

  - In   for maintenance

  - AK   for authorized customer

  - Se   for service (no standard access)

  - Fe   for production (no access)

  - En   for development (no access)

- Further messages and functions (below the contour field) include:

  - Name of the currently active field pair, numbered from 1 to 4

  - Field pairs displayed on the screen, numbered from 1 to 4, according to the selection in the selection dialog

  - Current source of data (LS4/file)

  - X/Y coordinates for the numerical display of the mouse pointer position (see Chapter 4.6)

  - Positioning of the contour field and optimization of display (see Chapter 4.6)

4.6   Coordinate Control and Display

In this part of the menu, located at the bottom right, the X- and Y-coordinates are displayed while the fields are being defined. In measurement mode, the position of the mouse pointer is displayed. Or, if a detection zone contour has been clicked on and dragged into position, this will be displayed. This feature makes it easy to localize objects and to create a detailed representation of particular areas.

To the right, next to the coordinate display, are arrow buttons for selecting the image area of the detection zones and warning fields and the section of the measurement contour that you want to be displayed. A very convenient function is located behind the centering point. When you click here, the detection zone, warning field and measured contour will

be ascertained and automatically displayed on the screen on their entirety. This feature gives you a quick overview of the field proportions.

4.7 Displaying Measurement Values and Fields in the Contour Area

The following color assignments are used to make it easier to differentiate among the various contours:

Contour	Color
Minimum detection zone	blue
Detection zone	red
Warning field	green
Measured contour	yellow / red
Selected mouse pointer area	yellow
Deactivated detection zone	light gray
Deactivated warning field	dark gray
Mouse pointer	dark blue

The information block in the main menu, bottom left, shows the display of the active field pairs as well as the field pairs selected for display.

Subject buttons

Function buttons

Standard buttons

Detection zone and warning field, inactive

Main menu line

Function line

Subject line

LS4-4 - fab-line2

File View Settings LS4 configuration Areas Diagnostics Safety Help

Display measurement data   LS4 configuration   Define areas   LS4 diagnostics

Detection zone 1

2.628
2.400
2.200
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
-0.200
-0.300

-2.273 -2.000 -1.750 -1.500 -1.250 -1.000 -0.750 -0.500 -0.250 0.000 0.250 0.500 0.750 1.000 1.250 1.500 1.750 2.000 2.273

Active area pairs in LS4: 1
Selected area pairs: 1, 4
Data source: LS4   File

X-Start -0.469 m   Y-Start 0.819 m
X-End   Y-End

LS4 connect   LS4 -> Measure   PC -> Define areas   AU

Information field line

Information block

Detection zone, red, active
Warning field, green, active
Measurement contour, yellow

Coordinate display

Contour field positioning

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5 Display the measurement contour, Subject Button

This menu allows you to select the active and inactive detection zones and warning fields to be displayed as well as the measured contour of the room. Using constant comparisons, the SIGUARD laser scanner LS4-4 ascertains the distance from the measured room contour to the detection zone and provides these data to the PC. If the measured contour penetrates the previously defined detection zone during a violation of the detection zone, the color of the measured contour in this area changes from yellow to red.

5.1 Define the detection zone display, Function Button

Click on the button „Define the detection zone display" to call up a dialog box for selecting the field pairs to be displayed. Active field pairs appear in red/green, and inactive field pairs in shades of gray.

No field pair needs to be selected for a neutral contour display (e.g. for a printout). As soon as a field is selected under „Define detection zones/warning fields" (subject button), or a field pair is selected by way of control cable X1, the selected/activated field pair appears on the screen again in red/green.

Function buttons, as described above

Dialog box for selecting the field pair display

Inactive field pair 4

Measured contour

LS4-4 - lab-line2

File   View   Settings   LS4 configuration   Areas   Diagnostics   Safety   Help

Display measurement data   LS4 configuration   Define areas   LS4 diagnostics

2.628
2.400
2.200
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
-0.200
-0.300

-2.273 -2.000 -1.750 -1.500 -1.250 -1.000 -0.750 -0.500 -0.250 0.000 0.250 0.500 0.750 1.000 1.250 1.500 1.750 2.000 2.273

Display areas

☐ Area pair 1
☑ Area pair 2
☐ Area pair 3
☑ Area pair 4

Cancel   OK

Active area pairs in LS4: 2
Selected area pairs: 2, 4
Data source: LS4   File

X-Start -0.469 m   Y-Start 0.819 m
X-End   Y-End

LS4 connect   LS4 -> Measure   PC -> Measurement data   DZ, WA   AU

Information block regarding the active and displayed field pairs

Display of the field violation

Detection zone violation with a change in color of the measured contour

Active field pair 1

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6   LS4 configuration, Subject Button

Select this menu to choose the functions for configuring the SIGUARD laser scanner LS4-4.

This subject area comprises data transfer as well as safety-relevant and non-safety-relevant parameter settings of the scanner.

⚠ Since this menu involves points relevant to safety, please note that access is possible only when the appropriate password is entered.

| Function buttons, as described below | Catalog of previously saved scanner configurations | File name entry | Date and time of the last change | Confirmation of dialog entries |
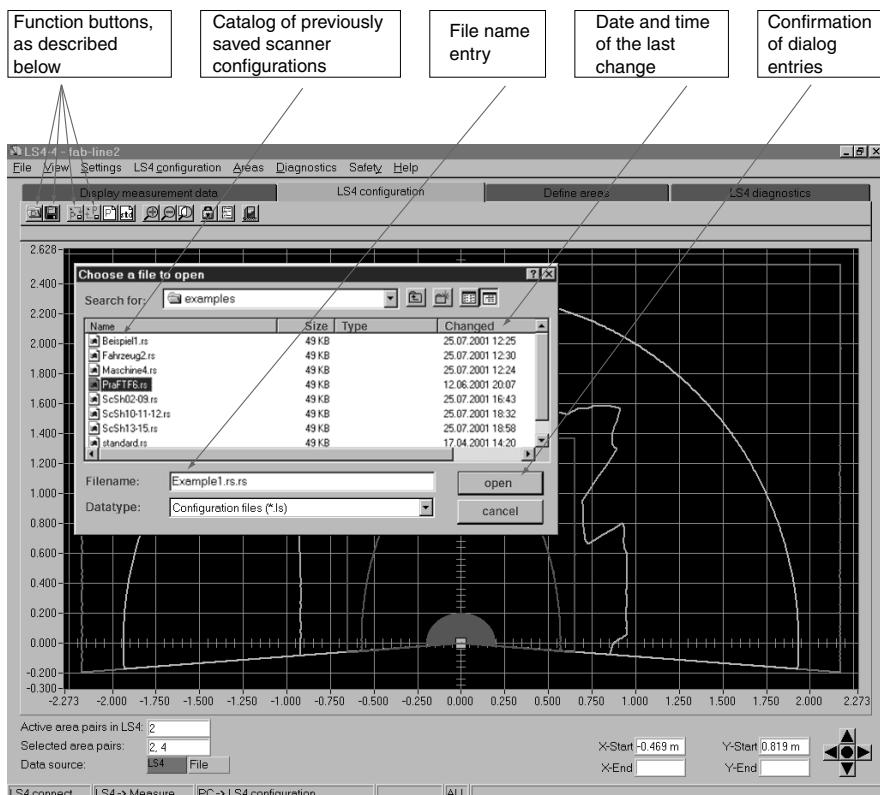
6.1 Load configuration data from a file, Function Button

Click on this button to open a dialog box providing an overview of the scanner configurations that are already saved in the PC. Enter and/or confirm the path and file name. Click on the button „Open" to confirm your selection, and the desired configuration will be called up. For a detailed description of the contents of the configuration data, see the section „Change configuration data", Chapter 6.5.

6.2 Save configuration data as a file, Function Button

Click on this button to open a dialog box that allows you to save the currently defined scanner configuration. Enter and confirm the path and file name. During the storage process, a progress bar with a confirmation message appears on the screen.

For a detailed description of the contents of the configuration data, see the section „Change configuration data", Chapter 6.5.

6.3 Retrieve configuration data from the LS4, Function Button

Click on this button to load the configuration data from the LS4-4 onto the PC. These data can be subjected to further processing or revised, if desired, by personnel with the required authorization. During loading, a progress bar with a confirmation message appears on the screen.

For a detailed description of the contents of the configuration data, see the section „Change configuration data", Chapter 6.5.

6.4 Transfer configuration data from PC to LS4, Function Button

Click on this button to load the configuration data from the PC onto the LS4-4 and to save the configuration data. During the loading and saving process, a progress bar with a confirmation message appears on the screen.

The information received by the LS4-4 will now be transferred back as echo data and displayed on the screen so that the safety official can confirm the transfer.

⚠ CAUTION! Since the PC is not a safety product and computer-specific errors can occur, the echo data transmitted by the LS4-4 must be checked for errors and confirmed by an authorized person.

For a detailed description of the contents of the configuration data, see the section „Change configuration data", Chapter 6.5.

6.5 Change configuration data, Function Button

Click on this button call up a two-part dialog for changing safety-relevant and non-safety-relevant parameters as well as data related to the detection zone. These system-specific data can be converted automatically into a .txt format and then printed out.

Data regarding detection zones and warning fields (folder)

Parameters belonging to the selected folder

Set value of parameters

Parameter-related status indicator

Save the data in .txt format for a subsequent printout

Time of the configuration change

Input field corresponding to the selected parameters
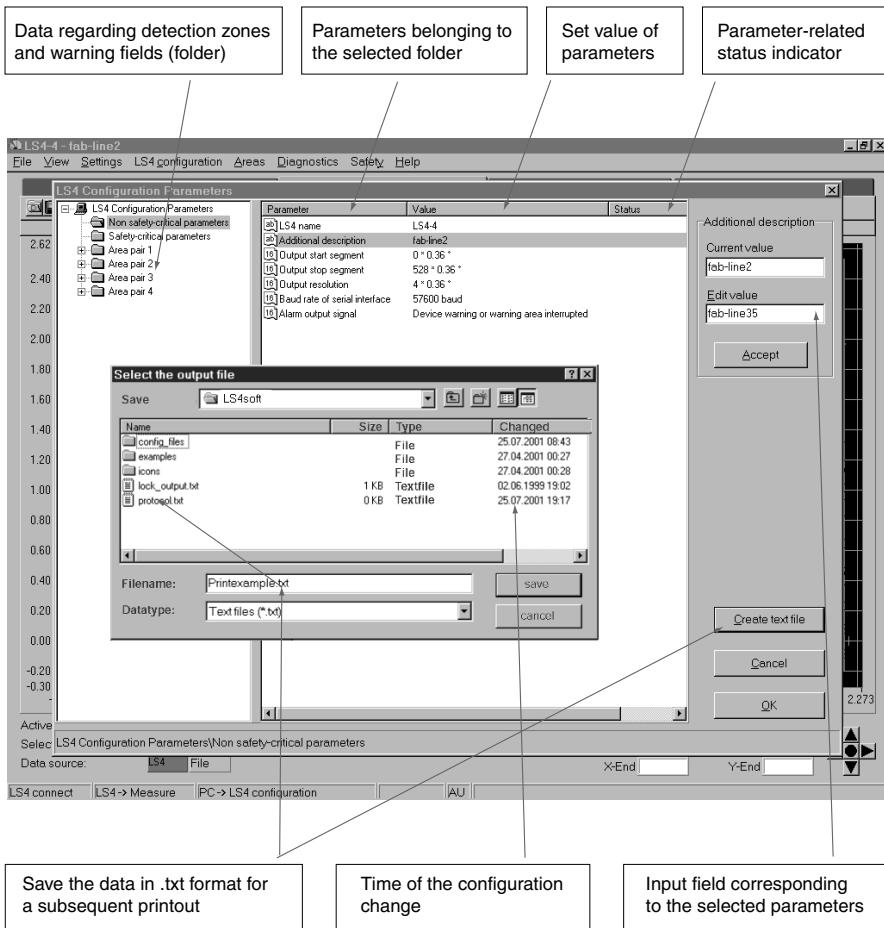
6.5.1 „LS4 configuration parameters" folder

This folder contains the check sum of the complete configuration data file. Following a data transfer, for instance, this sum is compared with the newly calculated check sum. If a bit was falsified during the data transfer, the two sums will no longer agree and an error message will appear.

6.5.2 „Non-safety-critical parameters" folder

This folder contains the following functions:

Parame-ter	Function / Setting	Status	Possible entries
LS4 name	Scanner name	*	As desired
Additional descrip-tion	Description of the applica-tion	*	As desired
Output start seg-ment	Screen dis-play of the first contour seg-ment	*	0 to 528 segments • 0 to 528 segments corresponds to 190° • 14 to 514 seg-ments corre-sponds to 180°
Output stop seg-ment	Screen dis-play of the last contour seg-ment	*	0 to 528 segments • 0 to 528 segments corresponds to 190° • 14 to 514 seg-ments corre-sponds to 180°
Output resolution	Number of measure-ment values per display interval. The lowest value in each inter-val is dis-played.	*	1 to 50 consecutive measurements
Serial in-terface	Change in baud rate	*	4800 to 115,200 baud
Alarm signaling type	Switches off the alarm output	*	Optionally for an error message, a violation of the warning field, or both

LS4Soft

6.5.3 „Safety-critical parameters" folder

This folder contains the following functions:

Parameter	Function / Setting	Sta-tus	Input Options
Application	Settings for restart inter-lock, detec-tion zone response times, and scanner startup functioning	*	The detection zone restart time can be set from 160 ms to 10160 ms, or the restart can be per-formed manually. Detection zone and warning field response time from 80 ms to 640 ms possible. Start interlock and start-up test or no test.
Measure-ment of start seg-ment	Technical measure-ment of the first contour segment	R	- - -
Measure-ment of stop segment	Technical measure-ment of the last contour segment	R	- - -
Dust sup-pression	Optimizes freedom from interference	*	Activate or deacti-vate
Admissible field pair change-overs	Determines sequence of changeovers as well as the startup field pair	*	Two input fields are provided by a dia-log. Click on the desired fields to make your selec-tion.

In the status field, R means „read only" and * means it is possible to change the parameters.

Changing the parameters described above has no effect on the number of measurements taken or on the effectiveness of the defined detection zones.

Additional Information (non-safety-critical parameters):

• **Start and stop segments:**
The output setting of the start and stop segments is used, for example, for contour measurement (e.g. 20˚ sections). This allows an individual, limited display of partial sections. Modifying these values merely changes the display of the contours on the screen; the number of measurements taken remains the same. This reduces both the amount of data and the transfer time.

• **Output resolution:**
A mean value for the display can be selected regardless of the number of measurements taken. If „15" is entered, for example, the lowest value within each interval of 15 measurement points is plotted, and these successive values are used to create a line graph. Using this function results in a smoother display of the contours. For a detailed display, use setting „1".

Additional Information (safety-critical parameters):

• **Application:**
Standardized parameter settings for safeguarding areas and safeguarding automatic guided vehicles (AGVs) are provided in a dialog.

Application	Parameter	Selection	Factory Setting
Safeguard-ing an area	Startup type	Start interlock Startup test No test	x
	Restart	Manual	x
	SF/WF re-sponse time	80 ms 640 ms	x
AGV	Startup type	Start interlock Startup test No test	x
	Restart	2 s	x
	SF/WF re-sponse time	80 ms 640 ms	x

Select the configura-tion block	Display the selected parameters	Dialog for selecting the standardized parameter blocks	Display of the parameters waiting to be activated
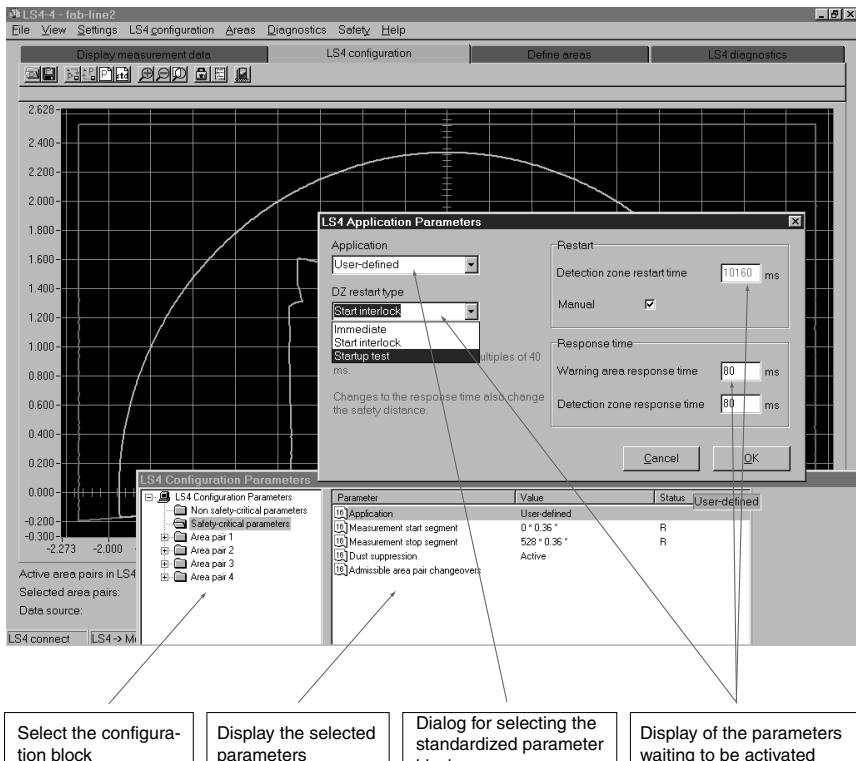
When start interlock is active, the safety outputs of the LS4-4 (OSSD 1 and OSSD 2) will not be enabled or switched „active high", even if the current detection zone is clear, until the RESTART button has been actuated for a period of 2 to 4 seconds (24 V to pin 2 of interface X1).

When startup test is active, after the scanner has been switched on, the safety outputs of the LS4-4 (OSSD1 and OSSD2) will not be enabled or switched „active high", even if the current detection zone is clear, until the detection zone is temporarily violated one time.

When restart interlock is active, the safety outputs (OSSD 1 and OSSD 2) of the LS4-4 will not be enabled or switched „active high", even if the current detection zone is clear, until the RESTART button has been actuated for a period of 2 to 4 seconds (24 V to pin 2 of interface X1). This function is active after every violation of the detection zone.

The **dust suppression function** of the SIGUARD laser scanner LS4-4 is a software function for increasing the availability of the laser scanner in the presence of dirt or small particles in the air, such as insects. If dust suppression is activated, a somewhat larger addition to the detection zone contour must be made. With or without dust suppression, and with a detection zone radius of up to 3.5 m, the addition has a value of 81 mm. With activated dust suppression and a detection zone radius of 3.5 m or more, the addition has a value of 98 mm. The addition is shown in the echo data.

Please refer to Chapter 7 for information on defining detection zones when the dust algorithm is active.

Due to its four freely programmable field pairs, the SIGUARD laser scanner LS4-4 can be used very flexibly in a wide range of applications. The selected detection zones are checked for plausibility when the admissible changeover sequence is chosen in the dialog „Admissible field pair changeovers". Inadmissible changeover sequences are detected and cause the OSSDs to be switched off. Furthermore, each field pair can be defined as the system startup field pair.

These features are useful with automatic guided vehicles, for instance, when the detection zone is changed over to accommodate straight and curved routes and when the vehicle starts up in a straight section.

Function button
"Change configuration
data"

Path within RS4soft
(from left to right)

Matrix for determining
admissible field pair
changeovers

Matrix for determining
admissible startup
field pairs
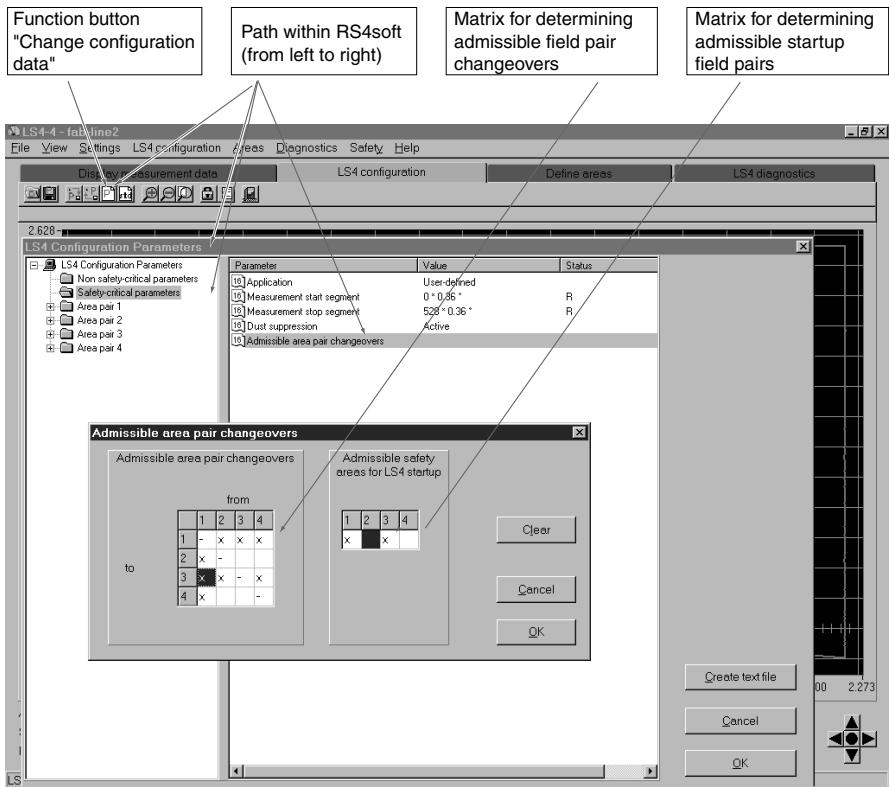
After the scanner configuration has been entered, it must be transferred to the LS4; to do so, click on the function button „Transfer configuration data from PC to LS4". If you forget to do this, the transfer dialog is automatically called up before another subject button can be selected. Due to the safe protocol, you can now view and confirm the echo data reflected by the scanner.

⚠ CAUTION! Since the PC is not a safety product and computer-specific errors can occur, the echo data transmitted by the LS4-4 must be checked for errors and confirmed by an authorized person.

Display of RS4 echo data	Configuration parameters
Selected setting	Confirmation button
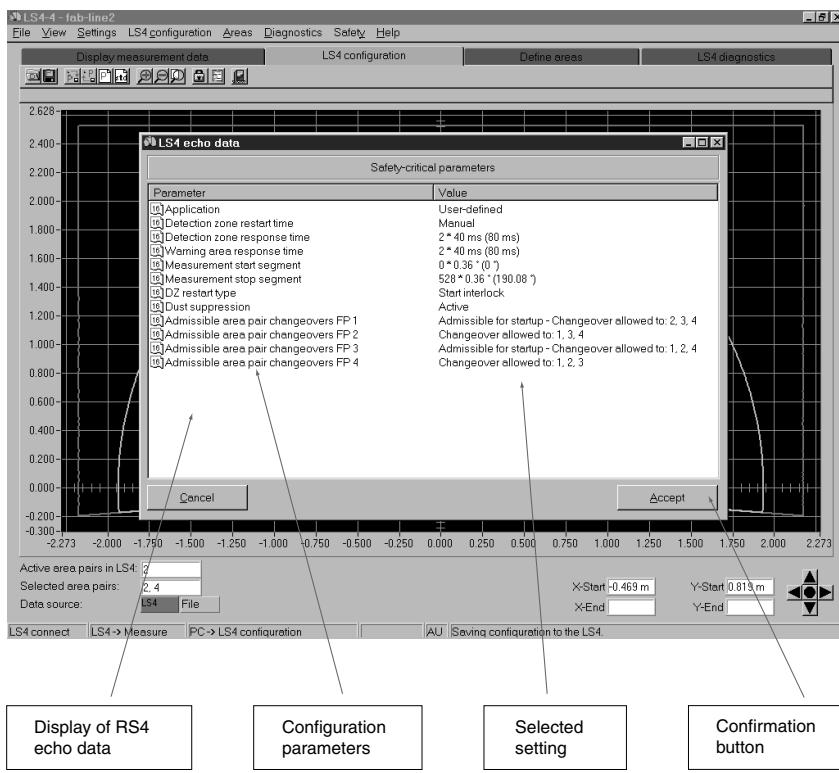
If the echo data are returned accurately, you must confirm the record by pressing the button „Accept". Changing a configuration can require that the detection zones be checked again. For information on the echo data, please refer to Chapter 7.13.

6.5.4 „Field pair 1 to 4" folders

Double-click on the folders to select the subfolders „detection zone" and „warning field". Selecting one of these subfolders causes field-specific data to appear in the right-hand section of the dialog box: name of the field, date and time of the latest change, field status, and information on admissible field pair changeovers. In addition, the minimum object width is stated with respect to the number of segments (x * 0.36°). This means that the lateral value in millimeters is dependent upon the maximum radius of the field contour.

6.6 Set standard values for LS4, Function Button

This function allows you to reinstate the factory-set configuration (delivery state) of the SIGUARD laser scanner LS4-4. As an alternative to this function button, you can also press the RESTART button (press pins 2 and 3 on connector X1) before switching on the scanner. Release the button after approx. 2 seconds; LEDs 2, 3 and 5 will be lit up in the scanner display. This means that the scanner has been reset. The table below describes the resultant setting:

Parameter	Value	Parameter	Value
Detection zone range	4 m	Application	Safeguarding an area
Detection zone display	190°	Restart	Manual
Detection zone response time	80 ms	Restart when reset	Activated restart interlock
Field pair changeover	No changeover	Startup type	None
Startup field pairs	1, 2, 3, 4	Dust algorithm	Activated
Detection zone name	- - -	Start segment output	0
Warning field range	5 m	Stop segment output	528
Warning field display	190°	Baud rate	57600 bd
Warning field, response time	80 ms	Name of the scanner	- - -
Alarm signaling type	Violation of the warning field	Description of the scanner	- - -

Please note that the reset function described above may not be repeated for a period of 2 minutes.

⚠ After determining the scanner configuration, the setting must be documented in suitable form at the monitored machine or system. You need to generate a text file of the configuration for this purpose.

The button „Generate text file" allows you to do this. Clicking on this button initiates a dialog for entering the file name and converts the data into .txt format. To make a printout, open the file (e.g. „LS4-4.txt") in a word processing program such as MS-Word® and click on the Print button.

The following information appears on the printout:

• Date, user, data source

• Scanner serial number, device type, software version

• Non-safety-critical parameters

• Safety-critical parameters

• Information on the detection zones and warning fields of all four field pairs

⚠ Read Chapter 9.1 to find out how to print out a detection zone contour.

7. Define detection zones/warning fields, Subject Button

This menu provides you with extensive possibilities for defining detection zones.

These include transferring data as well as creating and modifying the detection zones (for detecting the presence of personnel) and warning fields. Since this area involves safety-relevant functions of the scanner, access is possible only when the appropriate password is entered.

⚠ The smallest section of a detection zone must cover a lateral distance of at least 3.5 cm. When defining detection zones, make sure that no pin-shaped contours are set, as these do not provide a guaranteed safety effect.

The maximum selectable detection zone radii vary depending on the type of contour:

SIGUARD Laser Scanner LS4-4	Range	Factory Setting
Detection zone	4 m	4 m
Warning field	15 m	5 m
Contour measurement	50 m	- - -

The scanner is factory-programmed with semicircular detection zones (190˚) which will be in effect after the initial startup.

⚠ Please note that only detection zones (SF), and not warning fields (WF), may be used for the performance of safety-related tasks.

Load or save detection zone/warning field data

Choose the basic contours of the detection zone/warning field

Tools for modifying the basic contours

Data transfer to the scanner

Field catalog

Base point of the X and Y coordinates with the left and right field pair half

Factory-set detection zones and warning fields

Optimizing the display
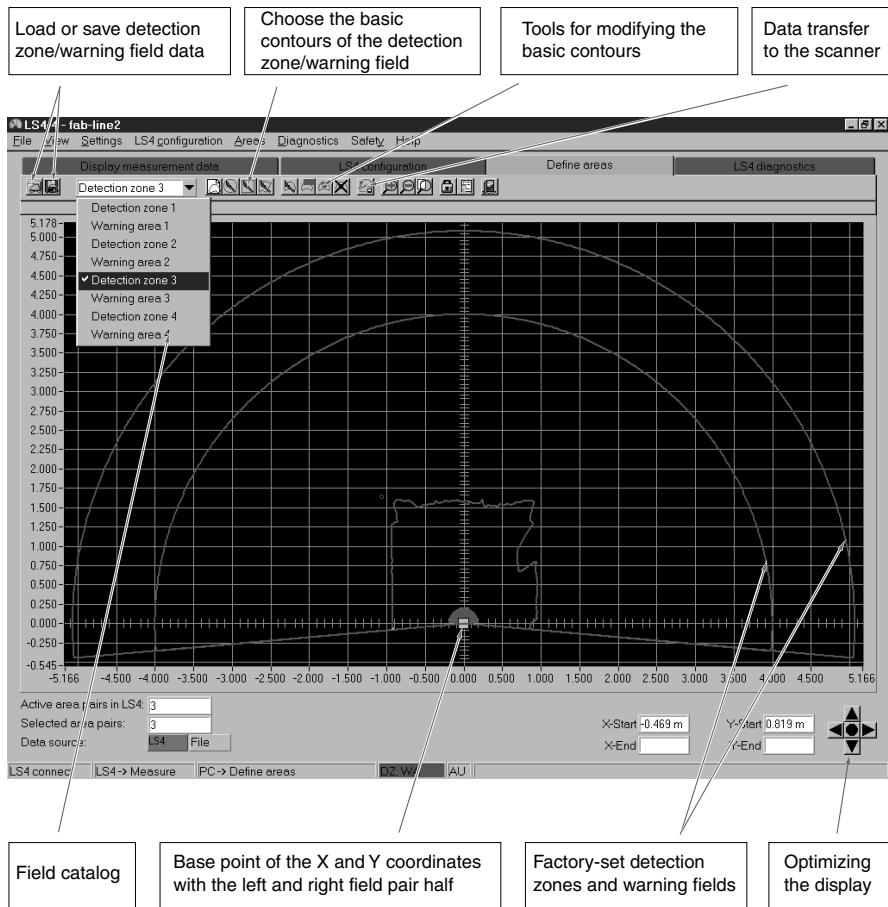
7.1 Load detection zone/warning field from file, Function Button

Click on this button to open a dialog box that will give you an overview of the field configurations already saved on the PC after you have entered the appropriate path and the file name. You can call up the desired configuration (file extension „.sf") using the button „Open" to make and confirm your selection. See Chapter 7.13 for information on transferring the data.

7.2 Save detection zone/warning field as a file, Function Button

Click on this button to open a dialog box that allows you to save the previously defined field configuration. Enter the path and the file name. Click on the button „Save" to confirm your entry, and the configuration will be saved as an .sf file.

7.3 Select detection zone/warning field, Function Button

When you click on this drop-down menu, all eight fields (4 detection zones and 4 warning fields) will be displayed for you to select. Use the mouse to click on the field pair you want to define. The current contours of the detection zone and warning field will be shown in red and green, respectively. Unselected field pairs appear in gray/light gray.

7.4 Enter detection zone/warning field, Function Button

Click on this button to open a dialog box for numerically entering the dimensions of the detection zone/warning field in millimeters. You can enter dimensions for the front, left and right edges of the zone/field to be defined. Confirm the edge dimensions. These will then be displayed on the screen in the appropriate color (detection zone in red, warning field in green).

Please refer to the subpoint „190˚ field pairs" in Chapter 9.2 .

7.5 Define elliptical detection zone/warning field, Function Button

When you click on this button, all of the tools except Zooming appear against a light gray background.

The program now waits for you to position the mouse pointer and set the coordinates for the elliptical contour. You can freely change the elliptical contour in the X- and Y-directions as long as you keep the right mouse button pressed within the contour field. The coordinate display is useful in helping you check the dimensions as you set them. When you have finished demarcating the field, release the right mouse button. The set mouse pointer marks the intersection of the horizontal and vertical line going to each side of the ellipsis. Equivalent sections of the field are always generated in the left and right halves of the display; these sections can be modified separately at a later point in time.

Please refer to the subpoint „190˚ field pairs" (see Chapter 9.2).

7.6 Define rectangular detection zone/warning field, Function Button

When you click on this button, all of the tools except Zooming appear against a light gray background.

The program now waits for you to position the mouse pointer and set the coordinates for the rectangular contour. You can freely change the rectangular contour in the X- and Y-directions as long as you keep the right mouse button pressed within the contour field. The coordinate display is useful in helping you check the dimensions as you set them. When you have finished demarcating the field, release the right mouse button. The set mouse pointer marks the corner point of the horizontal and vertical line of the rectangle contour. Equivalent sections of the field are always generated in the left and right halves of the display; these sections can be modified separately at a later point in time.

Please refer to the subpoint „190˚ field pairs" (see Chapter 9.2).

Detection zones and warning fields, 1 to 4 each

X-line/Y-line intersection - defined using the button "Define elliptical detection zone/warning field"

Defined using the button "Define rectangular detection zone/warning field"

Selection of five basic field contours

Distinguishing between the left and right field pair halves using a plus or minus sign

Field pair center line

Coordinates of the mouse pointer
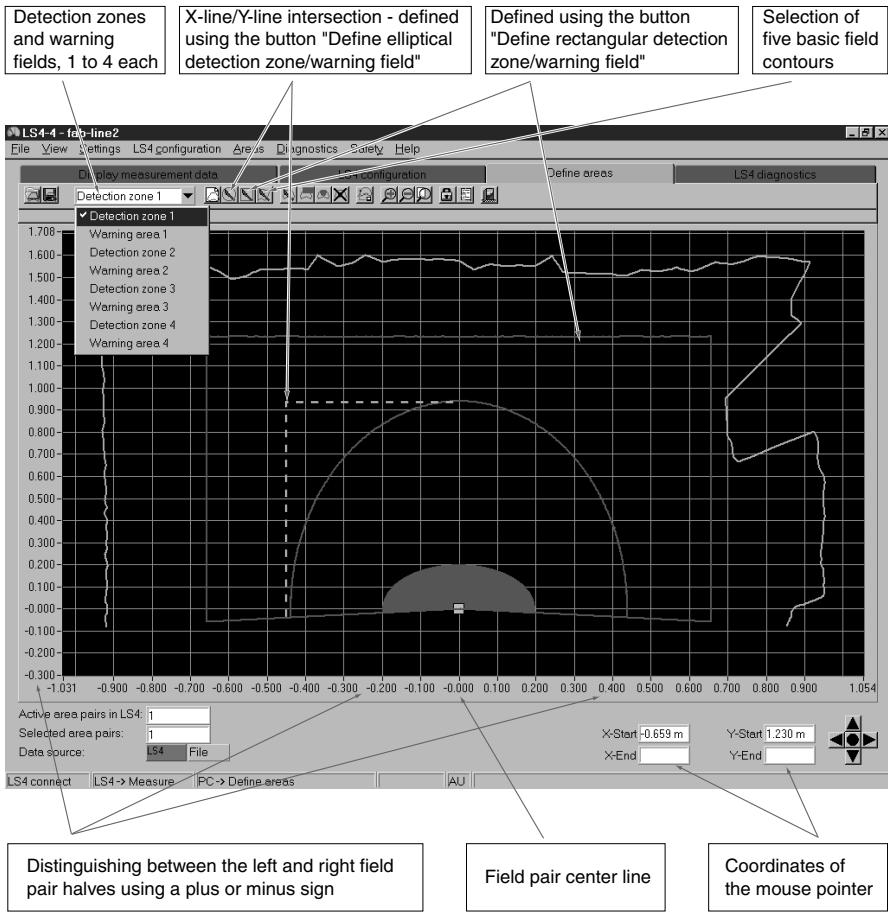
A minus sign preceding the mouse pointer coordinates designates the left half of the field pair, or the area below the scanner zero axis.

7.7 Define polygonal detection zone/warning field, Function Button

When you click on this button, all of the tools except Zooming appear against a light gray background.

The program now waits for you to position the mouse pointer. Click on the right-hand mouse button to „draw" the contour of the polygon point for point. The points along the contour are always entered clockwise from left to right. As long as the mouse button remains pressed within the contour field, you can freely shift the current line segment in the X- and Y-directions. The coordinate display is useful in helping you check the dimensions as you set them. Once you release the mouse button, the process is complete and the line is set. Beginning with the first point set by the mouse pointer, one line segment is added to the contour with every click of the mouse button. When the contour is complete, simply press the right-hand mouse button.

Please refer to the subpoint „190˚ detection zones" (Chapter 9.2).

Button for activating the polygon function	e.g. 1st, 2nd, 3rd and 4th mouse click for the current field	Displayed deactivated detection zone and warning field (gray scale)	End point set by clicking the right mouse button	Measured contour
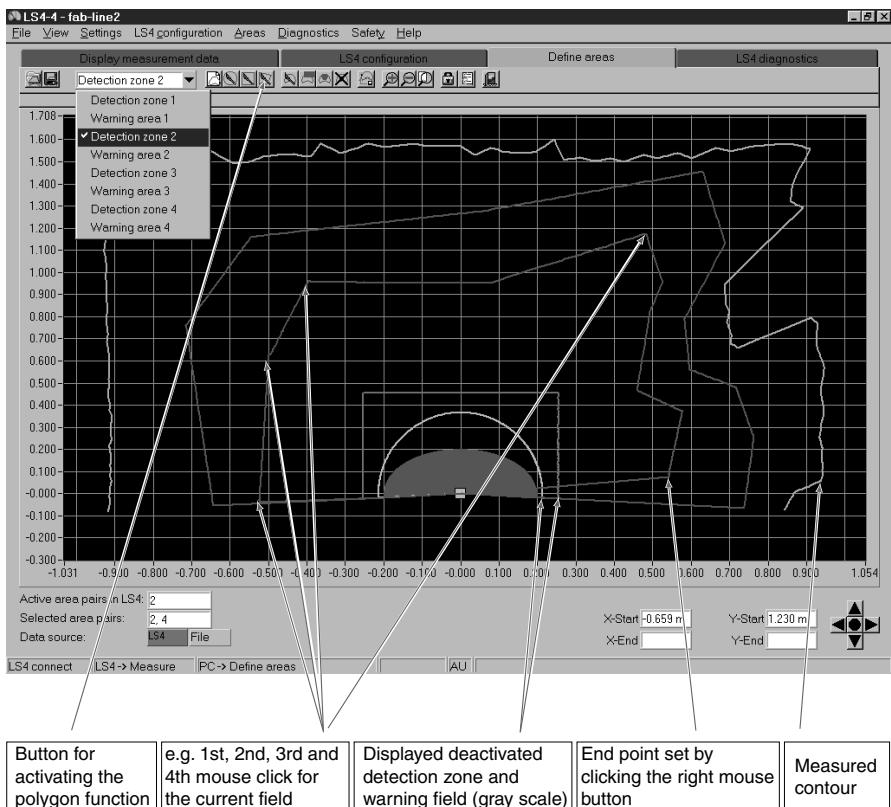
7.8   (freistehend)

7.9 Change detection zone/warning field segment, Function Button

Once a contour is specified, it can be modified by setting two coordinate points with respect to the beam axis. When you click on this button, all of the tools except Zooming appear against a light gray background. The program now waits for you to position the mouse pointer and click, thereby setting the coordinates for the two coordinate points. Use the coordinate display to check your selection. The section of the contour between the points is a line showing the connections to the previous contour. The connection itself follows the beam axis. After you have set the first corrective point, the program provides you with a yellow auxiliary line as a reference.

Connective lines following
the beam axis

Sample contour
for comparison

Auxiliary line
(beam axis)

First and second
coordinate point

7.10 Limit detection zones/warning field, Function Button

Click on this button to open a dialog box that allows you to
limit the dimensions of the field by making a numerical input
in millimeters. This refers to the front, left and right edges of
the field. After you confirm the edge dimensions, the limited
contour will be displayed.

| Limiting measures to be specified in the dialog | Button for activating the segment limitation | Limited contour | Sample contour for comparison |
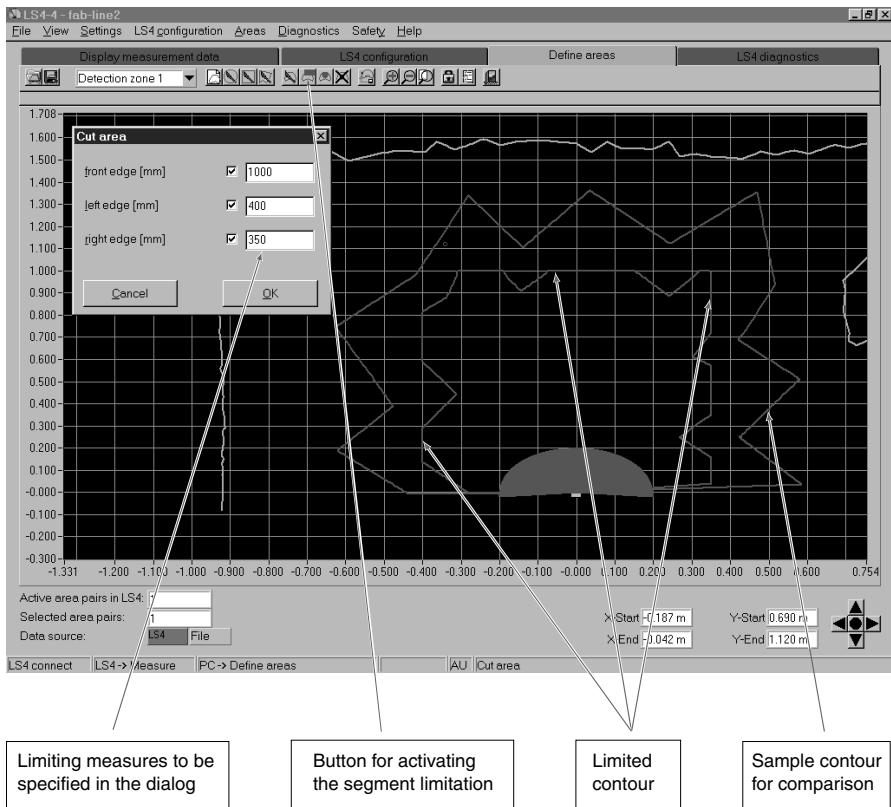
7.11 Blanking out a detection zone/warning field segment, Function Button

Once a contour is specified, you can blank out segments of the detection zone by setting two coordinate points. The segments between these two points will be blanked out. When you click on this button, all of the tools except Zooming appear against a light gray background.

The program now waits for you to position the mouse pointer and click, thereby setting the coordinates for the beginning and the end of the segment to be blanked out. The section of

the contour between the points is blanked out in the direction of the beam axis. After you have set the first corrective point, the program provides you with a yellow auxiliary line as a reference. The coordinate display is useful in helping you check your setting of the blanked out area.

| Button for activating the segment change | Sample contour for comparison | First and second coordinate point | Auxiliary line (beam axis) | Connective line following the beam axis |
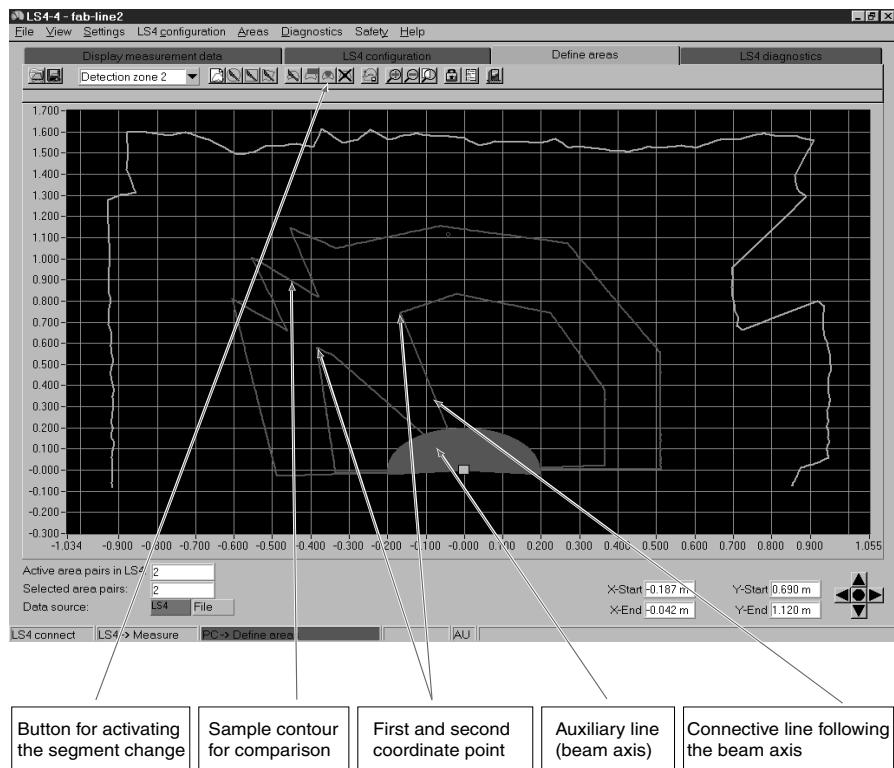
If you blank out sectors that can be entered or walked through, hazards to personnel can result if the minimum safety distance is no longer met. Additional measures must be taken to safeguard the danger zone in such cases.

7.12 Delete detection zone/warning field, Function Button

If you select this function, the detection zone definitions and warning field definitions are replaced by the factory settings (4 m radius for the detection zone, 5 m radius for the warning field).

7.13 Transfer detection zone/warning field from PC to LS4, Function Button

Click on this button to open a dialog box that gives an overview of the previously changed zone/field contours. This list allows you to select the zones/fields that you want to be transferred to the LS4-4.

Once the dialog has been confirmed, the loading/saving process begins and a progress bar appears on the screen. The SIGUARD laser scanner LS4-4 sends the information it received back to the PC as echo data so that the data transfer can be verified. The transferred detection zone contours appear in a dialog; the contours must be checked and the dialog must be acknowledged accordingly. After the check sums have been recalculated, the transfer is concluded with an OK message.

⚠ CAUTION! Since the PC is not a safety product and computer-specific errors can occur, the echo data transmitted by the LS4-4 must be checked for errors and confirmed by an authorized person.

Number of the detection zone

Automatically determined detection zone addition
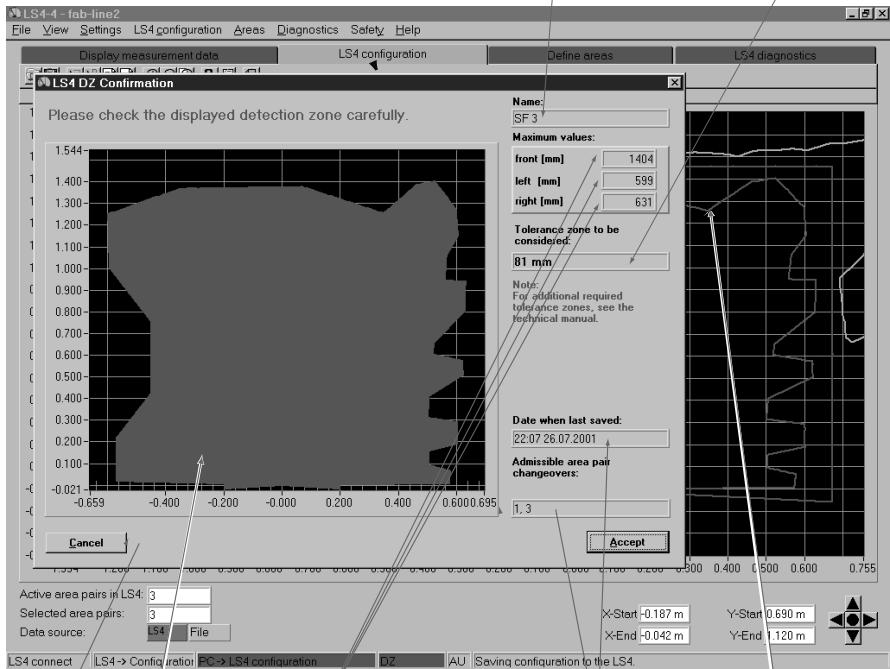
Echo dialog

Echo data - contour

Registered maximum values of the detection zone

Date when admissible FP changeovers were saved

Detection zone to be transferred

The echo data contain the detection zone contours, the maximum dimensions, the detection zone number, the date and time they were saved, the admissible detection zone changeovers, and the display of the detection zone addition. The latter point must first be considered by the user when defining the detection zones. For instructions on how to do this, refer to the Technical Description of the SIGUARD laser scanner LS4-4.

After the detection zone definition has been completed, the configuration must be documented in a suitable form at the monitored machine or system. Please see Chapter 9.1.

8 LS4 system data, Subject Button

This menu allows you to call up device-specific identification data and special functions.

8.1 Load system data from the LS4, Function Button

Click on this function button to transfer device data with a logistical emphasis from the LS4-4 to the PC:

- Software version (Firmware)
- Designation, name
- Additional description
- Serial number
- Current authorization level

These data can also be archived as a text file on the PC.

8.2 Display LS4 error list, Function Button

This function button provides you with access to an LS4-4-internal ring memory in which the error messages of the eight most recent events are documented. The first position of the memory contains the most recent error message. In addition, you can see the sum of all the generated error messages. The information provided by this list enables you to draw very good conclusions as to possible causes of error. For an interpretation of the list of parameters, please refer to Chapter 16 in the Technical Description of the SIGUARD laser scanner LS4-4.

8.3 Calibrate window monitoring, Function Button

It is necessary to perform a device-internal calibration of the window monitoring after the scanner window has been replaced, for instance.

⚠ Please note that only trained, expert personnel are allowed to replace and calibrate the exit window. This function can be accessed at the „Service" authorization level (or higher) and requires the use of the security diskette. The password can be found in Chapter 3.3.

8.4 Reset LS4, Function Button

Click on this function button to send a reset command from the PC to the scanner. This function can be used, for instance, if there is no manual RESTART button and an error message was issued due to dirt buildup on the scanner window. Once the window has been cleaned and the error message has been reset, the scanner resumes its normal operation.

9 Additional Functions on the Main Menu Line

This chapter describes additional special functions that are not provided by the subject buttons.

9.1 Menu „View"

Function „Save diagram as a file"

Click on the subpoint „Save diagram as a file" to open a dialog box for saving the displayed detection zone and warning field contours in .bmp format (bitmap). For documentation purposes, this screen shot can be called up using the program MS-Paint®, for instance, and supplemented with additional information. Enter the path and file name, and then confirm both in order to save the diagram as a file. During the storage process, a progress bar with a confirmation message appears on the screen.

9.2 Menu „Settings"

Subpoint „PC configuration"

Function „Interface"

Click on the subpoint „Interface" to open a dialog box that allows you to set the parameters for the interface (comport) and the baud rate (data transfer speed).

Function „Language"

Click on the subpoint „Language" to open a dialog box that allows you to select the language of the user interface and the program texts. The available languages are German and English. Please note that a change in language will not take effect until the LS4Soft program has been restarted.

Function „Change diagram color"

Click on the subpoint „Change diagram color" to change the background color of the contour window from black to white (and vice versa).

This function makes the screen shots of the measurements more suitable for printing.

Function „190˚ detection zones and warning fields"

Click on the subpoint „190˚ detection zone/warning field" to expand the definition of detection zones and warning fields by 10˚. The registration of measurement values is not affected by this change.

Subpoint „Display messages"

Click on the subpoint „Display messages" to open an information window showing a list of the operator steps performed since the software startup. The window can be maximized to allow for a better overview.

9.3 Menu „Detection zones/warning fields"

Function „Modified detection zones/warning fields"

Click on the subpoint „Modified detection zones/warning fields" to open an information window showing all of the detection zones and warning fields that have been modified in the PC but have not yet been saved to the LS4-4. Each of these fields is identified by a marker. The markers remain in place until the detection zones and warning fields are saved to the LS4-4.

9.4 Menu „Security"

Function „Change password"

Click on the subpoint „Change password" to open a dialog box for setting the access level (Maintenance [In] or Authorized customer [AK]). After making your selection, enter the password for the appropriate level. Confirm your entry by typing the password again in the second input field.

Please note that an access level of „Authorized customer (AK)" is required in order to be able to change the passwords. The password must consist of at least six but no more than eight letters and/or digits. The characters being entered are concealed from view.

⚠️ Please keep the password in a location that is inaccessible to unauthorized personnel.

Function „Reset password"

In the event that a password is lost, it is possible to define a new password. Use the subpoints „Reset password" and „Generate one-shot password" to create a security password that is shown in red. Fax or mail this password to Siemens AG along with the complete address of your company, the user name, and the scanner serial number. You will immediately be sent a confirmed one-shot password which must be entered in the dialog „Setting new passwords".

Once the new passwords have been entered in both fields, you can access the scanner on the „Authorized customer (AK)" level.

If the confirmed one-shot password is entered incorrectly, the SIGUARD laser scanner LS4-4 signals an error message at LED 5. In addition, an error message to that effect will appear on the screen after approx. 2 minutes. Please note that LS4Soft is disabled during this time period and will not be able to process any new entries.

9.5 Menu „Help"

Function „Info"

The subpoint „Info" shows the software version and the time at which the LS4Soft software was created.

10   Additional Information and Summary

10.1   Initial Configuration

- Carefully study the guidelines and standards that are valid for your application. (Consult Chapter 2.4 of the LS4-4 Technical Description.)

- Read the LS4Soft User Manual and the Technical Description of the SIGUARD laser scanner LS4-4 thoroughly.

- Start your PC with all required peripheral devices – but without the scanner connection.

- Install LS4Soft.

- When unpacking the SIGUARD laser scanner LS4-4, avoid touching the exit window and the diffusing screens.

- Plug in the SIGUARD laser scanner LS4-4 using connector X1 as described in the instructions.

- Connect the SIGUARD laser scanner LS4-4 to the PC using connector X2 as described in the instructions.

- Once the operating voltage is applied, the scanner signals communication readiness after approx. 20 s. You can see this state when the message „LS4 connect" appears on the screen.

- The SIGUARD laser scanner LS4-4 is delivered with factory-set standard parameters programmed for the maximum detection zone size.

- As a result of the factory setting, each field pair consists of a detection zone and a warning field with exactly the same dimensions, making them appear as a single contour. It is always a field pair that is activated.

- Since restart interlock is activated, it is not possible to enable the OSSDs until 24 V is applied at pin 2 of connector X1. Please note the supply voltage specifications in the Technical Description of the SIGUARD laser scanner LS4-4, Chapter 4.2.

- Please be aware of detection zone violations which may occur due to the maximum selected size of the detection zone.

- Please document the scanner configuration as specified in Chapter 6.6.

10.2 Changing a Scanner Configuration or Field Definition

- Faultless data communication must be established before any changes can be made. This state is signaled on the screen by the message „LS4 connect".

- In order to make changes, you must have access to the authorization level „Authorized customer".

- Changes are only possible if a configuration has been loaded onto the PC. You can load a configuration either from the hard drive or from the SIGUARD laser scanner LS4-4.

- Changes to a configuration are not accepted by LS4Soft until you confirm them by pressing the buttons „Accept" or „OK".

- Changes do not take effect until the data has been successfully transferred to the scanner.

- If detection zones are loaded as a file from the hard drive, for instance, you must verify the plausibility of the scanner configuration.

- Please consider the necessary safety distance and the required additions to the detection zone.

- You must comply with the safety precautions described in the LS4Soft User Manual and in the Technical Description of SIGUARD laser scanner LS4-4.

- Please document the scanner configuration as specified in Chapter 6.6.

10.3 Creating a Configuration Without a Connected Scanner

- After calling up LS4Soft, select the authorization level „Authorized customer".

- The initial display of the measurement field does not show any field contours.

- Enter the password for the appropriate user level.

- You can use the subject button „LS4 configuration" to load a configuration file from the hard drive onto the PC. The file extension is „.rs".

- Note that configuration files contain scanner configurations as well as field definitions.

- You can use the subject button „Define detection zones/ warning fields" to load a field file from the hard drive onto the PC. The file extension is „.sf".

- Please note that field files do not contain any scanner configurations.

- Saved files can be loaded onto the SIGUARD laser scanner LS4-4.

10.4 Replacing Devices

- After a replacement scanner has been connected to the PC, load the configuration data first. The status information will then be displayed on the screen so that it can be verified.

- Identical configurations can be identified by the output of the date and time when the field was saved, among others.

- If the scanner is new, you can program it more quickly by transferring the previous configuration file, as long as this still corresponds to the requirements of the application.

- When replacing a device, make sure that the scanner parameters and the complete detection zone definitions are transferred correctly.

- Compare the data of the previous scanner with the echo data of the new scanner.

- Comply with the safety precautions in the Technical Description of the SIGUARD laser scanner LS4-4.

- Please document the scanner configuration as specified in Chapter 6.6.

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